

How Do Insurance Companies Survive A Natural Disaster?

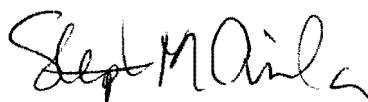
An Honors Thesis (HONRS 499)

By

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All of the natural disasters in the past years have inspired me to research the ways insurance companies make it through natural disasters. Natural disasters cause millions of dollars in damages to corporations, and in turn, the corporations look to insurance companies to pay for those losses. My thesis covers different methods that insurance companies can use to protect themselves before and after a natural disaster. My paper also talks about the effects each of the methods has on policies.

- I would like to thank Dr. Stephen Avila for advising me through this project. He was a great inspiration and a wonderful resource throughout the entire process.

Introduction

Over the past year, America has been struck by a variety of natural disasters. This has left parts of our country with battle wounds. What are the businesses in those areas suppose to do to recover from these damages? A key part of the recovery process for these businesses lies in the hands of the insurance companies. The preparation of the insurance company in the handling of the claims can make or break businesses after a natural disaster.

The insurance industry plays a crucial role in the rehabilitation of a region affected by a natural disaster and the economy of the whole nation. The insurance companies pay out money to get the businesses operational once again. The amount and kind of insurance along with the speed with which the claims are handled determine how quickly the region will get back to pre-disaster form if at all. Insurance companies write contracts to businesses. The contract is an agreement between the insurer which is the insurance company and the insured which is the business seeking insurance. The contract states that the insured agrees to pay a premium to the insurer in exchange for the insurer's guarantee to pay a defined amount of money or to provide defined services if a covered loss occurs during the policy's term. The contract defines the perils that will be covered. A peril is a cause of loss, such as fire or windstorm, with respect to property, or an accident with respect to health (Black). If a business does not have enough insurance or has uncovered perils, the business could suffer unpaid damages that they can not cover, and in turn, they go bankrupt. Insurance companies need to make sure they have sufficient reserves for the contracts they

have insured. Insurance companies with insufficient reserves will be unable to pay for the damages they have insured. This could lead to the insurance company going bankrupt, and increases the possibility of the insured businesses becoming bankrupt.

Effects

A wide variety of areas can be affected if an insurance company does not correctly prepare for natural disasters. Nancy L. Chambers of Waterloo Regional Municipalities Insurance Pool said, “We’re hit when catastrophe losses hit the market, and there were a lot of storms and catastrophes’ in 2005 that will affect insurance buyers ‘across the board’” (Bradford). The country’s economy is affected through business interactions and the stock market. Consumers everywhere are affected if a damaged business is unable to deliver products around the country that consumers or businesses need to continue serving their communities. One example is the oil rigs in the Gulf of Mexico that sent crude oil across the United States for companies to make into gasoline. The lack of oil could cripple the United States economy. People depend on gasoline to get them to and from work, to take their children to school, and to fuel semis to deliver various products across the United States.

This chain of events could lead to a decrease in company profits and a potential drop in the stock market. The stock market would obviously be hurt by the plummeting insurance company’s stock. The insurance company’s stock would cease to exist due to the company’s bankruptcy. Stocks belonging to businesses that are no longer able to make a profit because their workplace is

damaged would also take a fall. If the insurance company goes bankrupt from a large disaster, then they would be unable to pay the claims from businesses that the insurance company insures. The small claims could accumulate for these businesses until they also are unable to make a profit. These various chain reactions could have a damaging effect on the United States along with the World's Economy. Therefore, it is critical that insurance companies only insure contracts that they can cover and hold sufficient reserves.

Costs

The first thing that insurance companies need to keep in mind is the wide range of costs that can arise from a natural disaster. Hurricane Katrina alone cost insurers an estimated 40.4 billion dollars. The three hurricanes (Katrina, Wilma, and Rita) together cost an estimated 57.6 billion dollars. This total was more than twice the annual total for other US natural disasters (Planet Ark 28 December 2005).

These costs arise from a wide range of coverages that can be insured. One example is the civil authority coverage. This coverage pays for "business interruptions that arise out of the orders of civil authorities" (Pahl). If a mayor orders that a city be evacuated, then the insurance company insuring this coverage must pay for all profits that would have been earned during the time that the city had to be evacuated. Also replacing a building can be very extensive. The insurance company must pay to have the damaged building demolished. Then, the insurance company must pay to construct the new building and also pay the business for any interruptions that they have incurred

during the process. There are also laws that affect the repairs done on buildings. Some areas have an ordinance-increased or law-increased cost of construction. These laws can state that if as little as one-third of a roof is damaged then the whole roof must be replaced. These laws also affect buildings. In some areas if one-half or less of a building is damaged, then the whole building must be replaced. Obviously these laws can lead to costs rising very rapidly (Pahl).

Cost Controlling Methods

One way that insurance companies can help control claims is to diversify the areas they insure. That way even if one area gets hit by a natural disaster the insurance company has premiums from the other areas to pay for those claims. This is the insurance version of not putting all your eggs in one basket.

Another way to control the amount of claims is to share the insurance with other insurance companies. This transaction is known as reinsurance. The risk of large businesses is too hefty for any one insurance company. One example is Hard Rock. Five insurance companies share the risk of Hard Rock's 25 million dollar first excess layer. Ace Limited Company insures 5 million, Swiss Re insures 4 million, Lloyd's of London insures 7.5 million, Essex Insurance Company insures 3.5 million, and RSUI Indemnity Company insures 5 million. Hard Rock's 131.5 million dollar second excess layer is insured the same way. One Beacon Insurance Company insures 15 million, Clarendon America Insurance Company insures 10 million, RSUI insures 15 million, Great American E&S Insurance Company insures 5 million, James River insures 14 million, Swiss Re insures 21 million, and Lloyd's of London insures 51.3 million (McLeod). This

is just one example of a group of insurance companies sharing the Hard Rock's 156.5 million dollars in potential losses.

Stipulations

Other ways to help keep costs down is to place different stipulations on the policies. To demonstrate the effect that different stipulations can have on these policies, I will compare the expected value and variance of an example distribution with different stipulations applied. I am using the expected value and variance because they are two standards of measuring policies. The expected value is the mean of the distribution. It is how much the insurance company can expect to pay. The variance is a measure of the spread of the distribution. A distribution with a small variance is expected to fall within a small range of numbers and a company with a large variance will fall within a large range. I will use the Weibull distribution with parameters $\tau=1$ and $\theta=1,000,000$ to describe the losses from a natural disaster. I picked the Weibull distribution because it is skewed right, meaning that small dollar claims are rare, and the more likely events will be very costly. The important formulas for the gamma distribution are the following:

$$f(x) = \frac{\tau \left(\frac{x}{\theta}\right)^{\tau-1} e^{-\left(\frac{x}{\theta}\right)^{\tau}}}{x}$$

$$F(x) = 1 - e^{-\left(\frac{x}{\theta}\right)^{\tau}}$$

$$E[x^k] = \theta^k \Gamma\left(\frac{1+k}{\tau}\right)$$

$$E[(X \wedge x)^k] = \theta^k \Gamma\left(\frac{1+k}{\tau}\right) \Gamma\left[1 + \frac{k}{\tau}; \left(\frac{x}{\theta}\right)^{\tau}\right] + x^k e^{-\left(\frac{x}{\theta}\right)^{\tau}}$$

The expected value of this distribution is \$1,000,000, and the variance is \$1,000,000,000,000.

The simplest stipulation that everyone is familiar with is a deductible. There are two types of deductibles that can be placed on a policy. The most common is the ordinary deductible. With an ordinary deductible, the insured pays for all losses below the deductible and pays the deductible for losses greater than the deductible. The insurer covers all expenses above the deductible. A policy with an ordinary deductible is distributed in the following manner:

$$\begin{array}{ll} y^I = & 0 & x \leq d \\ & x - d & x > d \\ y^P = & \text{undefined} & x \leq d \\ & x - d & x > d \end{array}$$

x is the amount of a potential loss and d is the deductible. y^I is the per loss random variable for the insurer and y^P is the per payment random variable for the insurer. y^P is undefined when $x \leq d$ because the insurance company does not get that information. The other type of deductible is a franchise deductible. With a franchise deductible, the insured pays for all losses below the deductible and pays nothing for losses greater than the deductible. If a loss exceeds the franchise deductible, the insurer pays for the total amount of the loss. A policy with a franchise deductible is distributed in the following manner:

$$\begin{array}{ll} y^I = & 0 & x \leq d \\ & x & x > d \end{array}$$

$$y^p = \begin{cases} \text{undefined} & x \leq d \\ x & x > d \end{cases}$$

Once again, y^p is undefined because the insurance company does not get this information. In my example, the expected value of a policy with an ordinary deductible of \$50,000 would be \$951,229, and the variance is \$997,622,238,560.42. This stipulation lowers the expected value by 4.8771 percent from the original expected value.

Another stipulation that can be placed on a policy to help control costs is a stop-loss limit. A stop-loss limit is a roof on the amount of money that an insurer will pay to an insured for a loss. In my example, the expected value of a policy with a stop-loss limit of \$5,000,000 would be \$74,117.40, and the variance is \$661,563,361,017.24. The stop-loss limit only lowered the expected value by .6738 percent. Often times a stop-loss limit and an ordinary deductible are placed on the same policy. This really helps control costs by eliminating all small losses, making the insured pay for some or all of every loss, and alleviating responsibility for all losses above a certain dollar amount. In my example, the expected value of a policy with an ordinary deductible of \$50,000 and a stop-loss limit of \$5,000,000 would be \$944,491, and the variance is \$930,214,030,631.31. When the deductible and stop-loss limit are put together, the expected value is lowered by 5.5509 percent. The final thing insurance companies can do to control costs is to purchase reinsurance. Reinsurance companies insure other insurance companies. In my example, the expected value of a policy with an

ordinary deductible of \$50,000, a stop-loss limit of \$5,000,000, and 15 percent reinsurance would be \$802,818, and the variance is \$672,078,593,468.14.

Coupling all three of these stipulations together really helps insurance companies control losses. In my example, the expected value was lowered by 19.7182 percent. When losses are in the millions and possibly billions of dollars, reducing the expected value of potential losses by nearly 20 percent produces a large amount of potential savings for the insurance companies.

Once the stipulations have been set on the policy, the actuaries must decide on an amount of reserves to hold in case of a claim. One simple way to do this is to set the reserve so that the probability that a loss will exceed the reserve is five percent. The following equation is used to determine that.

$$P[X > R] = .05$$

To meet that requirement in my example with no stipulations, the reserve would need to be \$2,645,000. However, if the deductible, stop-loss limit, and coinsurance are added, the reserve would be \$1,490,251.58. Adding the three stipulations lowers the reserve by 43.6578 percent.

Another way that insurance companies can keep payments low is to only insure certain perils. For example, some insurance companies will insure damage from wind but not from flooding. Then after the damages occur, the insurance company tries to classify the damages as being from flooding so that they do not have to cover it. For example, Hard Rock sued two of its ten property insurers for refusing to pay their parts of an estimated 175 million dollars. The

companies claimed that the damage was a result of flooding which was not a covered peril (McLeod).

Conclusion

With careful planning and thoughtful deliberation, insurance companies can help businesses that are suffering from the effects of natural disasters as well as assisting with the overall recovery of the area and a nation as a whole. I have mentioned a variety of ways insurance companies can go about achieving this goal. Whether they are watching the perils being insured or observing the stipulations being included on policies, insurance companies are doing as much as they can to reduce the effect of a natural disaster. Different insurance companies select their own methods to attain the same goal, returning post natural disaster areas back to normal.

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